

# Chapter 31

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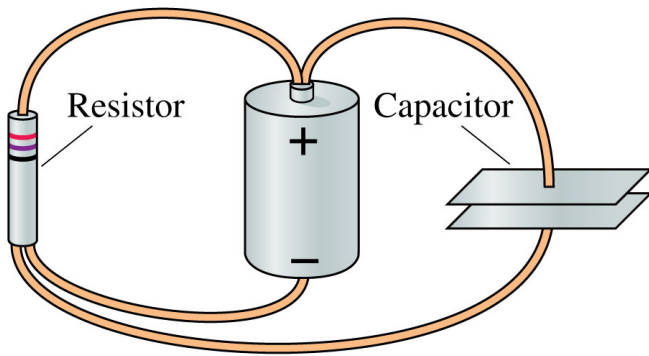
## Fundamentals of Circuits *(Circuit Elements and Diagrams & Kirchoff's Laws and the Basic Circuit)*

## 31.1:

# Circuit Elements and Diagrams

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Simple circuit of a resistor and a capacitor connected by wires to a battery.

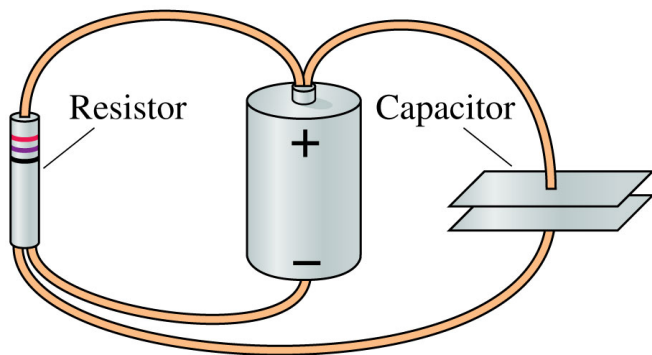


## 31.1:

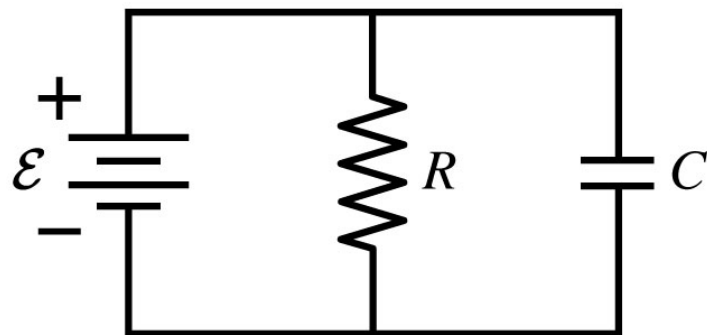
# Circuit Elements and Diagrams

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Simple circuit of a resistor and a capacitor connected by wires to a battery.



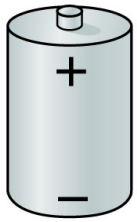
Equivalent circuit diagram



# 31.1: Circuit Elements and Diagrams

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Circuit elements with equivalent symbols..



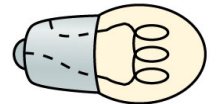
Battery



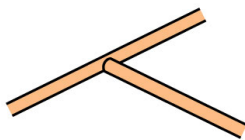
Wire



Resistor



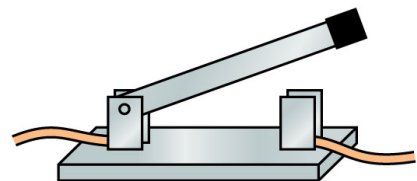
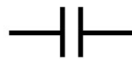
Bulb



Junction



Capacitor



Switch



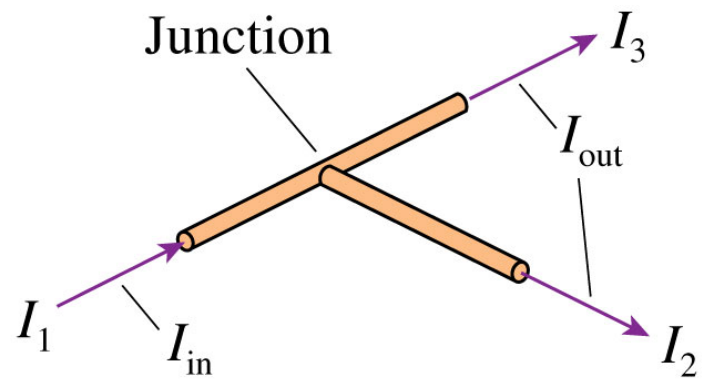
## 31.2:

# Kirchoff's Laws and the Basic Circuit

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For a circuit junction, *Kirchoff's Junction rule* holds...

$$\sum I_{in} = \sum I_{out}$$



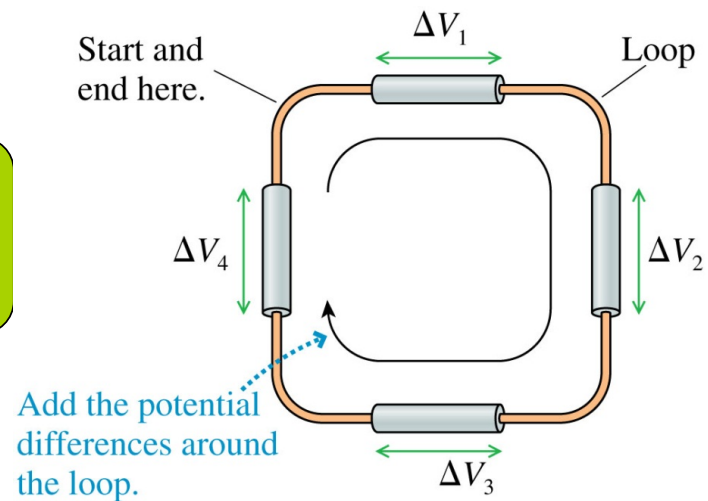
Junction law:  $I_1 = I_2 + I_3$

## 31.2:

# Kirchoff's Laws and the Basic Circuit

For a circuit, *Kirchoff's Loop rule* holds...

$$\Delta V_{loop} = \sum (\Delta V)_i = 0$$



Loop law:  $\Delta V_1 + \Delta V_2 + \Delta V_3 + \Delta V_4 = 0$

## 31.2:

# Kirchoff's Laws and the Basic Circuit

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Using *Kirchoff's loop law*...

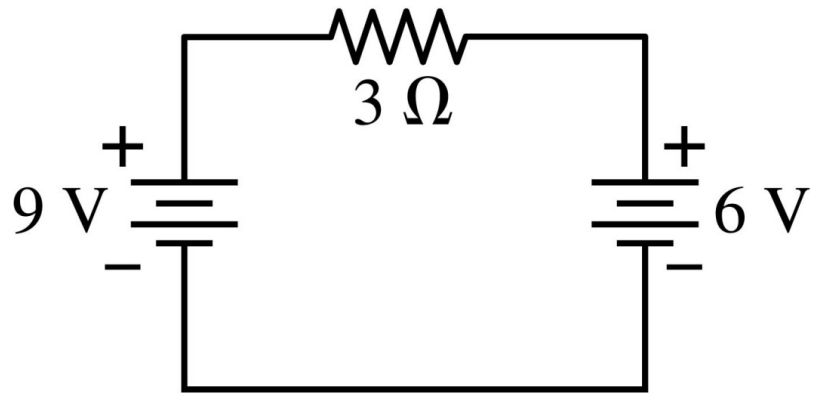
1. Draw a circuit diagram, labeling quantities.
2. Assign a direction to the current.
3. “Travel” around the loop.
4. Apply the loop law:

$$\sum (\Delta V)_i = 0$$

## Quiz Question 1

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The current through the  $3\ \Omega$  resistor is



- 1. 9 A.
- 2. 6 A.
- 3. 5 A.
- 4. 3 A.
- ⑤. 1 A.

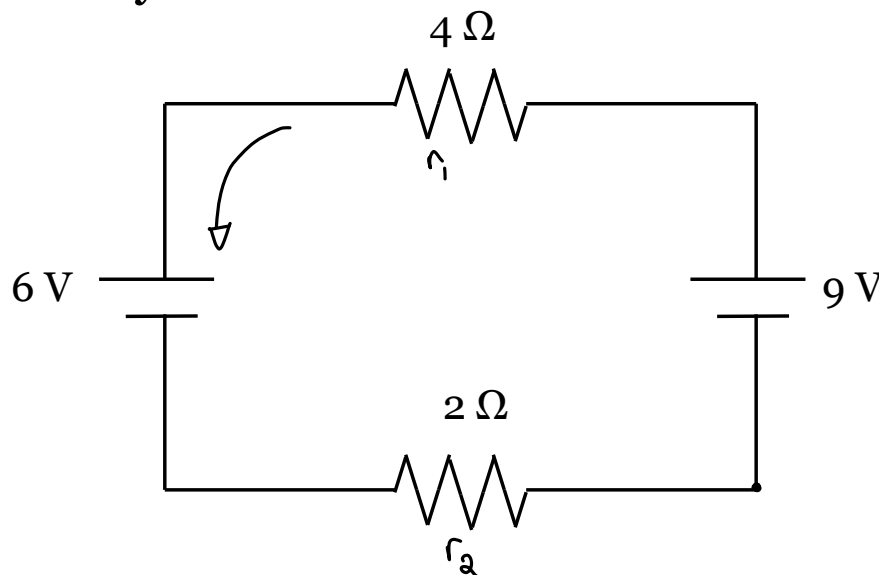


i.e. 31.1:

## Two resistors and two batteries

Analyze the circuit shown in the figure.

- Find the current in and the potential difference across each resistor.
- Draw a graph showing how the potential changes around the circuit, starting from  $V = 0V$  at the negative terminal of the 6 V battery.



$$I = \frac{V}{R}$$

$$0.5A = \frac{V}{2\Omega}$$

$$V = 1V$$

$$0.5A = \frac{V}{4\Omega}$$

$$V = 2V$$

$$9V - 4\Omega(I) - 6V - 2\Omega(I) = 0$$

$$3V - 6\Omega(I) = 0$$

$$6\Omega(I) = 3V$$

$$I = 0.5A$$